THE OLD PORCH AT BONCHURCH.

A WONDERFUL INSTRUMENT.

PROFESSOR MICHELSON'S "ECHELON SPECTROSCOPE."

IT SURPASSES THE PRISM AND GRATING IN RESOLVING POWER.

What is the most remarkable advance in optical research in many years, in the judgment of experts, is the invention of a new form of spectroscope by Professor A. A. Michelson, of the Ryerson Laboratory, University of Chicago. He has been using it this year for investigations of great delicacy, and descriptions of it are now creeping into the technical publications.

The old style of spectroscope was made with a prism. This broke up a ray of light into the constituent colors and spread them out in a rainbow-tinted band, the red at one end and the violet at the other. If the ray proceeded from the sun the prismatic ribbon was found to be crossed by a number of black lines. If it emanated from incandescent vapor the lines were bright instead of dark. The position of these lines along the spectrum, which can be measured with great precision, tells the scientist a good deal about the nature of the substance that emits the light, and reveals something in regard to its motion if, as is often the case, the object under examination be a star.

Naturally, so soon as spectroscopic work was undertaken by the astronomers it became desirable to stretch a spectrum out as far as possible, in order to separate adjacent lines. Hence a train, or series, of prisms was used, instead of a single prism. Thus a higher "dispersion" was secured, and the lessons of the lines in solar, planetary and stellar spectra could be more readily grasped. With faintly luminous objects, like nebulæ and very small stars, only a limited degree of dispersion is practicable; for when a spectrum is greatly expanded it becomes less and less visible, and beyond a certain point it will not reveal anything to the spectroscopist. On the other hand, when the light is intense, like that of the sun, and when it is important to distinguish positively between lines that occupy nearly the same position the utmost separative power is wanted, and it can be used with safety.

After a little it was found that an excellent spectrum could be obtained by a piece of apparatus quite unlike the prism. A small mirror, slightly concave, was ruled with fine parallel lines. This device, called a "diffraction grating," has been improved wonderfully by Professor H. A. Rowland, of Johns Hopkins University. His principal achievement in this field was in devising the machinery for ruling the lines. Many of the best gratings are only a few inches in diameter, but have from 10,000 to 20,000 lines to the inch! It is said, though, that the famous ruling engine in Baltimore is capable of cutting over 100,000 lines to the inch. The narrowness of such scratches is almost inconceivable.

The grating is superior to the prism in two respects. It is more compact and manageable, and it has a higher dispersive power. In the latter respect, if not in the former, the new instrument of Professor Michelson surpasses the grating. The best gratings now in service have a resolving power of 100,000. That of the spectroscope which Professor Michelson has recently been using is 300,000, and he expects soon to have one that will rate at 500,000. With such an inquisitor the physicist is sure to get at a host of secrets hitherto beyond his ken.

The general arrangement of this instrument is easily understood, even by one who does not master the principle on which it works. A series of glass blocks, shaped something like rather thick dominos, compose it. An idea of their appearance and position can be obtained by imagining these blocks to be placed on edge, on a table or other horizontal surface, close together, with the face of one against the back of the next. The spectroscope at the Ryerson Laboratory has eighteen of these pieces, and they are all about seven-eighths of an inch thick (eighteen millimetres, to be exact). It may be assumed that they are all of the same width, say three-quarters of an inch, and as they stand on their edges the "width" here means height above the surface of the table.

But the lengths vary. If a ruler or other straight edge be brought against the series, so as to bring their lefthand ends in a line, it will be discovered that the other ends do not match, but constitute a regular flight of steps. The first domino is an inch or more long. The second is shorter by one millimetre. The third is two millimetres shorter. The eighteenth is eighteen millimetres shorter, and therefore is not more than a third of an inch long.

When this instrument is in use the ray of light to be analyzed is sent through the whole series from the wide to the narrow end; and the magnifying apparatus or eyepiece is placed next the latter. It will be perceived, therefore, that if the beam be wide enough this succession of events will ensue: After going through the first plate in the series most of the light will pass on through the next one, but a small portion of it will come out into the open air, in consequence of the diminution in size of the second block. That portion which comes out will travel parallel with that which goes into the second plate, but it will move a trifle faster because the glass offers some resistance to its progress—only a little, yet enough to produce a certain peculiar optical effect.

At each step in the series this phenomenon is repeated. Another small portion of the original beam comes out into the air, but continues to go on in an unchanged direction. At the further end of the instrument, then, there are eighteen slices of the beam, each travelling at a slightly different rate.

The retardation in the progress of the light amounts to 20,000 waves for each plate it goes through. Therefore the small portion of the original bundle of rays that has traversed the whole eighteen plates is about 360,000 waves behind the portion that did not go through any of them. So soon as one recalls the fact that color is due merely to differences in the rate of vibration, he can see that this gradual retardation must break up the beam, not into all the colors of the rainbow, but into infinitesimally delicate shades of some one hue. The instrument is not intended to give a full spectrum, but to examine microscopically a minute portion of it.

Owing to its peculiar shape, Professor Michelson calls his device an "echelon spectroscope." Although the design is exceedingly simple, the construction is unspeakably difficult. The plan here employed for treating a light ray makes necessary a degree of uniformity in the thickness and levelness of the plates that can scarcely be imagined by the uninitiated. Workmanship of the most wonderful precision is required in the process of manufacture. In practice, the optician would make one plate of glass of the proper thickness and smoothness, having, as the mathematicians say, "perfectly plane and parallel surfaces," and then cut this up into the proper number of pieces.

A DUTCH WEDDING AN ORDEAL.

ITS CURIOUS FEATURES OTHER ODD CUSTOMS IN HOLLAND.

From The London Globe.

A Dutch wedding is a portentous business. Smart Holland does its devotions in barnlike French Protestant churches. The wedding service is mournful to a degree, and lasts two hours. The bridegroom, in full evening dress, and the bride, in orthodox white satin, sit upon chairs in front of the black-robed minister. He delivers an extempore address fairly bristling with personalities. Meanwhile relatives sob in pews, until finally every one who can prove the remotest connection with the bride kisses her.

Next follows a tremendous breakfast in French style. It is "de rigueur" for all the friends of the bride to send her in the morning a bouquet or basket of white flowers plentifully ribboned. With numbers of these a very gay effect is produced, though the Dutch are lamentably behind the times in table decoration and posey-making. With the advent of the "hors d'œuvre" come speeches. The bride's brother or other delegate first rings a small handbell. Then, amid a silence broken by the cheerful clicking of knives and forks, a health is proposed. Then comes a quaint postscript to this very ordinary ceremonial. Ladies and gentlemen must alike rise from their seats, and, solemnly filing up to the person toasted, touch his glass with their own. After a score of speeches the thing gets monotonous, but it is carried out to the bitter end. Any person omitted would feel aggrieved. In Holland it is the family before everything. A leading barrister was recently compelled to throw up an important case in order to attend the birthday dinner party of an aged father who lived three hours distant by rail.

The Dutch are excellent husbands, but quite preposterously jealous. An Englishman who found himself in a party consisting almost entirely of assorted couples, ventured to pay a few compliments and mild attentions to a charming young married woman. He even had the assurance to include her in a general offering of roses made to the company. The husband was furious. He cancelled a previously given dinner invitation, and there were awful rumors that, though duels are now very rare, he desired to challenge the offender, who wisely placed the sea between himself and his would-be opponent.

Babies have a comfortable time enough in Holland, where the cramping swaddling-pillow is replaced by English layettes. It is, however, expensive to know too many, for every woman who visits or is visited by nurse and infant for the first time must give the former at least five shillings.

Mourning is very long and very strict. Even the poorest leave off their gold cap pins and headpieces for more than a year after the death of a parent.

WHERE HE WOULD SERVE.

From The Cincinnati Enquirer.

"What do you want to enlist for, now that the war is all over?"

"I thought maybe I could get a job as substitute for those fellows who are getting kissed."

THE ISLE OF ROSES.

GLIMPSES OF THE BRIGHTEST GARDEN IN ENGLAND — TENNYSON'S HOME NEAR THE NEEDLES—A REVEL OF COLOR EVERYWHERE.

Freshwater Bay, August 26.

The Isle of Wight is about sixty miles in girth, as a white-winged yacht takes its measured flight around it. Within the same compass it would not be easy to find anywhere else in the world so many sources of pleasure and recreation for holiday-seekers of every rank and condition. The island is the favorite resting-place of the Court; it is the scene of social revels and the breeziest sport of high life; it is the retreat of the invalid and the refuge of the bookworm, and it is the paradise of the cheap tripper, and it brings to all a renewal of the joy of life and relaxation either from pleasures too enfeebling or from the business of the workaday world.

As there is yellow gorse in the wind-swept Isle of Man, where trees will not grow, so there are roses in the Isle of Wight, where every door-yard is brightened by their bloom, even as late as December. Breezy are the chalky downs which stretch from The Needles to Sandown Bay, but "the breath of the moist air is light around the unexpanded buds." Nowhere in England, itself a land of flowers, are roses earlier or later or lovelier than in the Queen's favorite island, where the air is soft and velvety even in midwinter, and where the sheltered valleys are rich in verdure when the east winds are blowing in March. It vies with Cornwall and South Devonshire in the possession of a semi-tropical climate, which is not enervating in summer, since the heat is tempered by cool, invigorating breezes. There are bolder sea walls and grander scenery elsewhere in England, but the Isle of Wight is the loveliest and most restful of all the flowering meads in the fairest of lands.

MANY ROUTES TO THE ISLAND.

There are many routes for entering the island, but the one which I prefer leads through Hampshire to Lymington, whence there is a short passage across the Solent to Yarmouth, with Hurst Castle and The Needles close at hand. The quaint town on the sandy shore is not the chief attraction, but the old-fashioned stage coach drawn up at the entrance to the pier, with the driver, who has stepped out of the pages of Dickens. It is a delightful reminiscence of old-time England. The coach, with every seat taken outside and in, and with boxes and bags heaped on top or strapped on behind, or stowed away in mysterious receptacles underneath, is the exact reproduction of the vehicle in which Mr. Pickwick and his friends used to make their journeys. It may well be, for it has been in use for over fifty years on the island. The passage of the coach is the event of the day, and women and children swarm out of the wayside cottages as it trundles by. Every passenger pays his penny at the tollgate, and the driver cracks his whip, exchanges jokes with villagers, and comments sagely upon the state of the crops and the condition of the roads. With his ruddy face and genial manner, he is the familiar figure of the highroad, whom everybody knows and likes, and whose opinions on every subject, from weather to matrimony, are delivered with oracular dignity. Coach and driver are survivals of old-time conditions as quaint as any church or cottage in the isle of roses.

The terminus of this short stage route is Freshwater Bay, with a cluster of villages back of it, and one famous house, Farringford. One of these strings of cottages winds about the high flank of Afton Down, and ends in a ribbon of sand and breaker; another is a tangle of lodging-houses and shops at the foot of a second beautiful down, with the Tennyson beacon-cross on its crest; another group, a mile away, encircles an old stone church with a square, embattled tower; there is a fourth cluster of houses at School Green, and there are scattered files of

THE TENNYSON HOUSE, FARRINGFORD.